

**UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE**

**CONSERVATION PRACTICE STANDARD**

**RIPARIAN FOREST BUFFER  
(Acre)**

**CODE 391**

**DEFINITION**

An area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

**PURPOSES**

- Create shade to lower water temperatures to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody debris for aquatic and terrestrial organisms.
- Create wildlife habitat and establish wildlife corridors.
- Reduce excess amounts of sediment, organic material, nutrients, and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Provide a harvestable crop of timber, fiber, forage, fruit, or other crops consistent with other intended purposes.
- Provide protection against scour erosion within the floodplain.
- Restore natural riparian plant communities.
- To increase carbon storage in plant biomass and soils.
- To provide stability to the streambank by maintaining protective tree and shrub root systems.

- Protect, maintain, and restore habitats for certain endangered or threatened plants and animals.

**CONDITIONS WHERE PRACTICE APPLIES**

On stable areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas with ground water recharge that are capable of supporting woody vegetation.

**CRITERIA**

**GENERAL CRITERIA APPLICABLE TO ALL PURPOSES**

The location, layout, and density of the riparian forest buffer will accomplish the intended purpose and function. The buffer will consist of a zone (identified as zone 1) that begins at the normal water line, or at the upper edge of the active channel or shore and extend a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water course or water body.

Dominant vegetation will consist of existing naturally regenerated, or planted trees and shrubs suited to the site and the intended purpose. Selection of locally native species will be a priority when feasible. Plantings will consist of two or more species with individual plants suited to the seasonal variation of soil moisture. Plant types and species shall be selected based on their compatibility in growth rates and shade tolerance. Zone 1 should always be established to hardwood species.

Occasional removal of some tree and shrub products such as high value trees is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance. Felling and skidding of trees shall be directed away from the water course or water body. Skidding will

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service or visit our web site at: <http://www.al.nrcs.usda.gov/Tech/ConStandards.htm>

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be done in a manner to prevent creation of ephemeral channels perpendicular to the stream.

An adequate upstream or adjacent seed source must be present when using natural regeneration to establish a buffer. Exotic invader species which have low wildlife value must be controlled when using natural regeneration.

Necessary site preparation and planting for establishing new buffers shall be done at a time and manner to insure survival and growth of selected species. Only viable, high quality, and adapted planting stock will be used.

Site preparation shall be sufficient for establishment and growth of selected species and shall be done in a manner that does not compromise the intended purpose. See Standard 490 - Forest Site Preparation.

The method of planting for new buffers shall include hand or machine planting techniques, be suited to achieving proper depths and placement of planting stock roots, and not impair the intended purpose and function of the buffer. See Standard 612 – Tree/Shrub Establishment.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose. Water course crossings and livestock watering shall be located and sized to minimize impact to buffer vegetation and function.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Comply with applicable federal, state and local laws and regulations during the installation, operation (including harvesting activities) and maintenance of this practice.

**CRITERIA TO REDUCE EXCESS AMOUNTS OF SEDIMENT, ORGANIC MATERIAL, NUTRIENTS AND PESTICIDES IN SURFACE RUNOFF AND REDUCE EXCESS NUTRIENTS AND OTHER CHEMICALS IN SHALLOW GROUND WATER FLOW.**

An additional strip or area of land, zone 2, will begin at the edge and up-gradient of zone 1 and extend a minimum distance of 20 feet, measured horizontally on a line perpendicular to the water course or water body. The minimum combined width of zones 1 and 2 will be 100 feet or 30 percent of the geomorphic flood plain whichever is less, but not less than 35 feet. (Note: The active flood plain may be narrower than the valley bottom if the valley formed under different hydrologic conditions.) Figure 1 illustrates examples of zone 1 and 2 widths for watercourses and water bodies. For water quality benefits, the width of riparian forest buffers may be as much as 300 feet in floodplains where flooding is occasional, frequent, or very frequent. Where water quality is the primary objective, at least 50 percent of the buffer area should be planted to two or more oak species. Up to 50 percent of the buffer area may be planted to either pine species or other hardwood species where the soils are suitable for the selected species.

Criteria for zone 1 shall apply to zone 2 except that removal of tree and shrub products such as timber, nuts and fruit is permitted and encouraged on a periodic and regular basis provided the intended purpose is not compromised by loss of vegetation or harvesting disturbance.

Zone 2 will be expanded in high nutrient, sediment, and animal waste application areas where the contributing area is not adequately treated or where an additional level of protection is desired.

A Zone 3 shall be added to the riparian buffer when adjacent to cropland or other sparsely vegetated or highly erosive areas to filter sediment, address concentrated flow erosion, and maintain sheet flow (see figure 2). The Filter Strip standard (practice code 393) shall be used to design Zone 3.

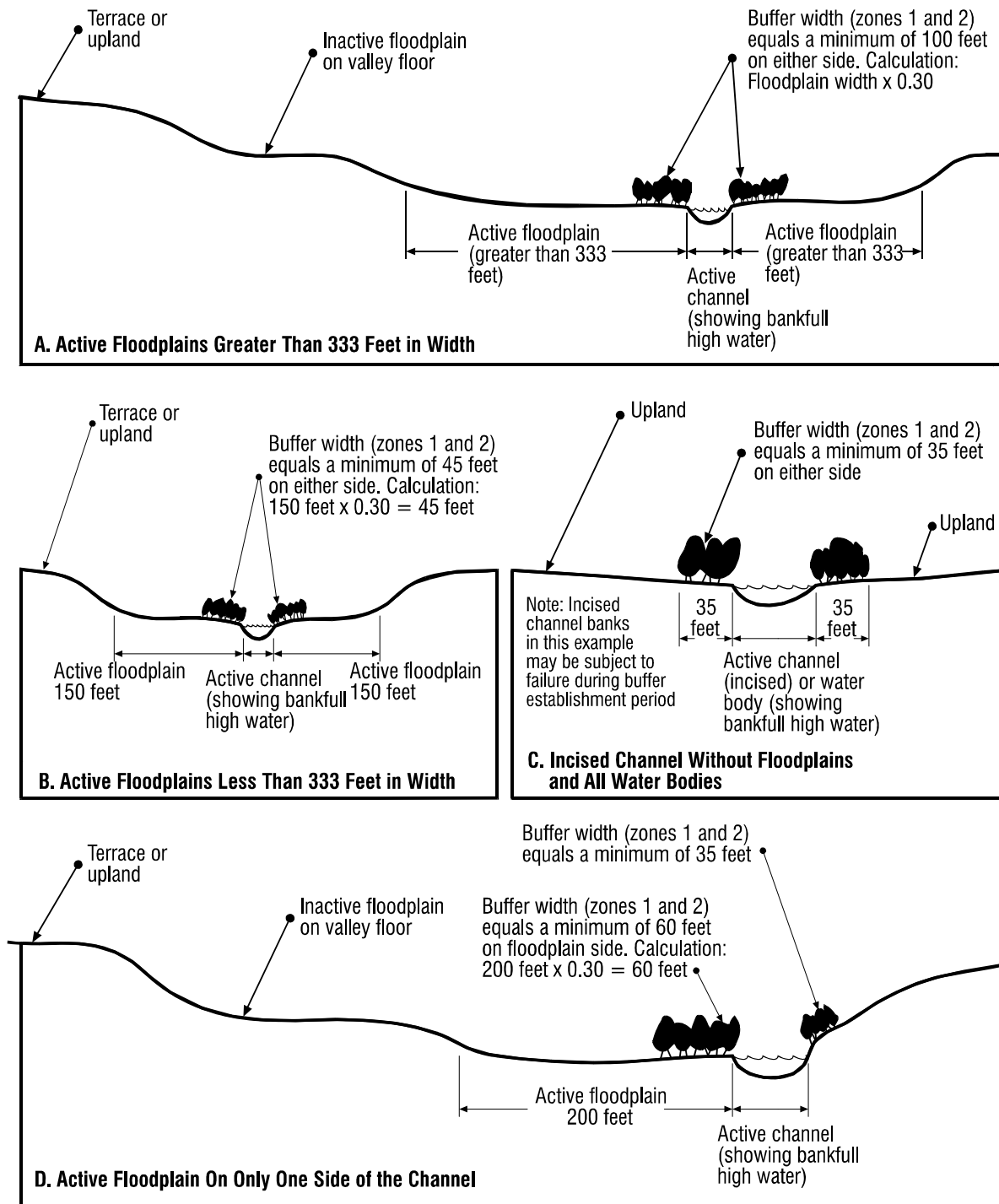


Figure 1. Examples of riparian forest buffer widths for watercourses and water bodies.

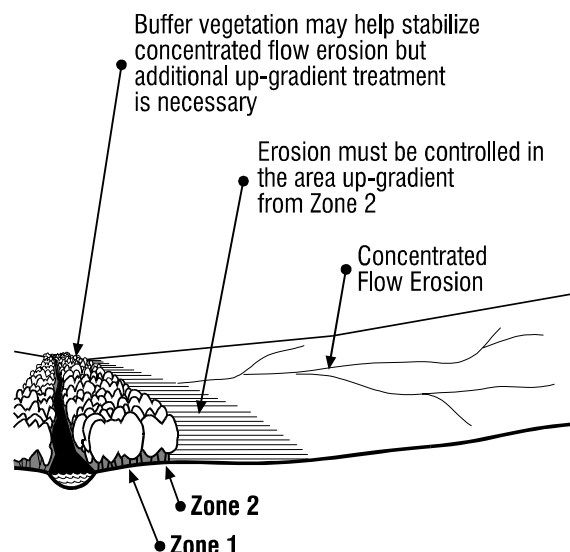


Figure 2. Control of concentrated flow erosion.

### **CRITERIA TO PROVIDE HABITAT FOR AQUATIC ORGANISMS AND TERRESTRIAL WILDLIFE**

Favor tree and shrub species that are native and have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. Hardwood species should be the predominant species in riparian buffers where wildlife is a primary objective. Seventy-five percent of the hardwood species should consist of two or more oak species. If the area is suitable for growing pine, the buffer may have up to a 20 percent pine component. Consider species that resprout when establishing new rows nearest to watercourses or bodies. For detritus and large woody debris, use species that will meet the specific requirements of fish and other aquatic organisms for food, habitat, migration and spawning.

Use recommendations from regional or other large-scale evaluations and plans when designing, locating and connecting buffers for indicator and/or target species of wildlife, fish and other aquatic organisms. The minimum buffer width for wildlife habitat may be up to 300 feet depending on the species of wildlife. Wildlife

benefits are increased when riparian forest buffers connect adjacent forest land.

### **CONSIDERATIONS**

The severity of bank erosion, concentrated flow erosion or mass soil movement and its influence on existing or potential riparian trees and shrubs should be assessed. Watershed-level or contributing area treatment or bank stability activities may be needed before establishing a riparian forest buffer.

When concentrated flow erosion and sedimentation cannot be controlled vegetatively, consider structural or mechanical treatments.

Favor tree and shrub species that are native, non-invasive, or have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides.

Tree and shrub species, which may be alternate hosts to undesirable pests should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Plants that deplete ground water should be used with caution in water-deficit areas.

Allelopathic impacts of plants should be considered.

Joining of existing and new buffers increase the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned or drooping will increase moderation effects. For watercourses, buffers established on both sides will enhance multiple values.

Consider the positive and negative impacts beaver, muskrat, deer, rabbits and other local species may have on the successful management of the riparian and stream system. Temporary and local population control methods of these kinds of local species should be used cautiously and within state and local regulations.

The location, layout and density of the buffer should complement natural features and mimic natural riparian forests.

## PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site and recorded using approved specification sheets, guidesheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

## OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life.

The riparian forest buffer should be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, pesticides, livestock or wildlife damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

As applicable, control of concentrated flow erosion and sediment deposition shall be controlled by an adjacent filter strip.

Any removals of tree and shrub products shall be conducted in a manner that maintains the intended purpose.

For purposes of moderating water temperatures and providing detritus and large woody debris, riparian forest buffer management must maintain a minimum of 50 percent canopy cover.

For providing habitat and corridors for wildlife, manage the buffer to favor food, shelter and nesting cover that would satisfy the habitat requirements of the target wildlife species.

For purposes of reducing excess pollutants in surface runoff and shallow groundwater or providing habitat and corridors for wildlife, manage the dominant canopy to maintain maximum vigor of overstory and understory species.

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals to assure buffer function shall not compromise the intended purpose.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

## REFERENCES

Alabama Forestry Commission. 1993. Alabama's Best Management Practices for Forestry 1993.

Castelle, A.J., A.W. Johnson, C. Conolly. 1994. Wetland and Stream Buffer Size Requirements - A Review. Journal of Environmental Quality 23: 878-882.

Croonquist, M.J. and Brooks, R.P. 1993. Effects of habitat disturbance on bird communities in riparian corridors. Journal of Soil and Water Conservation 48: 65-70.

Lowrance, R., R. Leonard, and J. Sheridan. 1985. Managing riparian ecosystems to control nonpoint pollution. Journal of Soil and Water Conservation 40: 87-91.

Schultz, R.C., J.P. Colletti, T.M. Isenhardt, W.W. Simpkins, C.W. Mize, and M.L. Thompson. 1995. Design and Placement of a Multi-species Riparian Buffer Strip. Agroforestry Systems 29: 201-225.

U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry, 1991. Riparian Forest Buffers -- Function and Design for Protection and Enhancement of Water Resources. NA-PR-07-91. Prepared by: David J. Welsch. Radnor, PA.

U.S. Department of Agriculture, Forest Service, Southern Region, 1992. Stream Habitat Improvement Handbook. Tech. Publ. R8-TP 16. Prepared by: Monte E. Seehorn, Atlanta, GA.